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(54) **A probe microphone**

(57) A probe microphone comprising an acoustic transducer (4) with a cavity (2), to which a probe tube (1) and an impedance matching tube are connected, wherein the matching tube is divided into several small tubes (6, 6') of a total sectional area substantially corresponding to the sectional area of the probe tube (1). The small matching tubes (6, 6') improve the frequency response because of their acoustic loss. Moreover, a further improvement is achieved when the matching tubes (6, 6') are of different lengths, reflected signals thereby cancelling each other. As a result, a probe microphone with a more uniform frequency response than previously known is achieved.

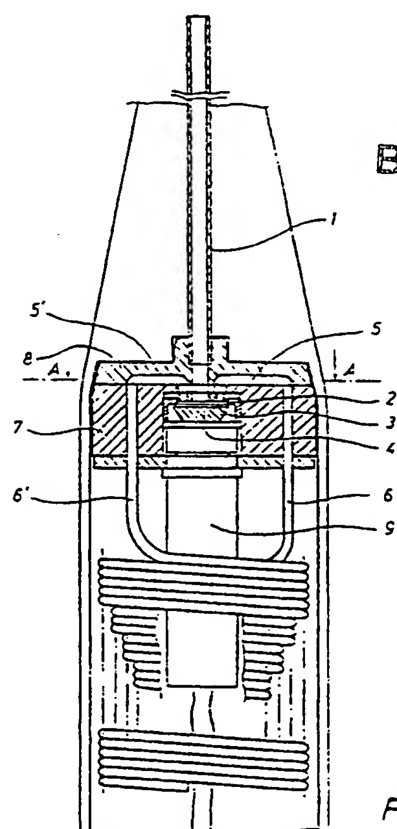
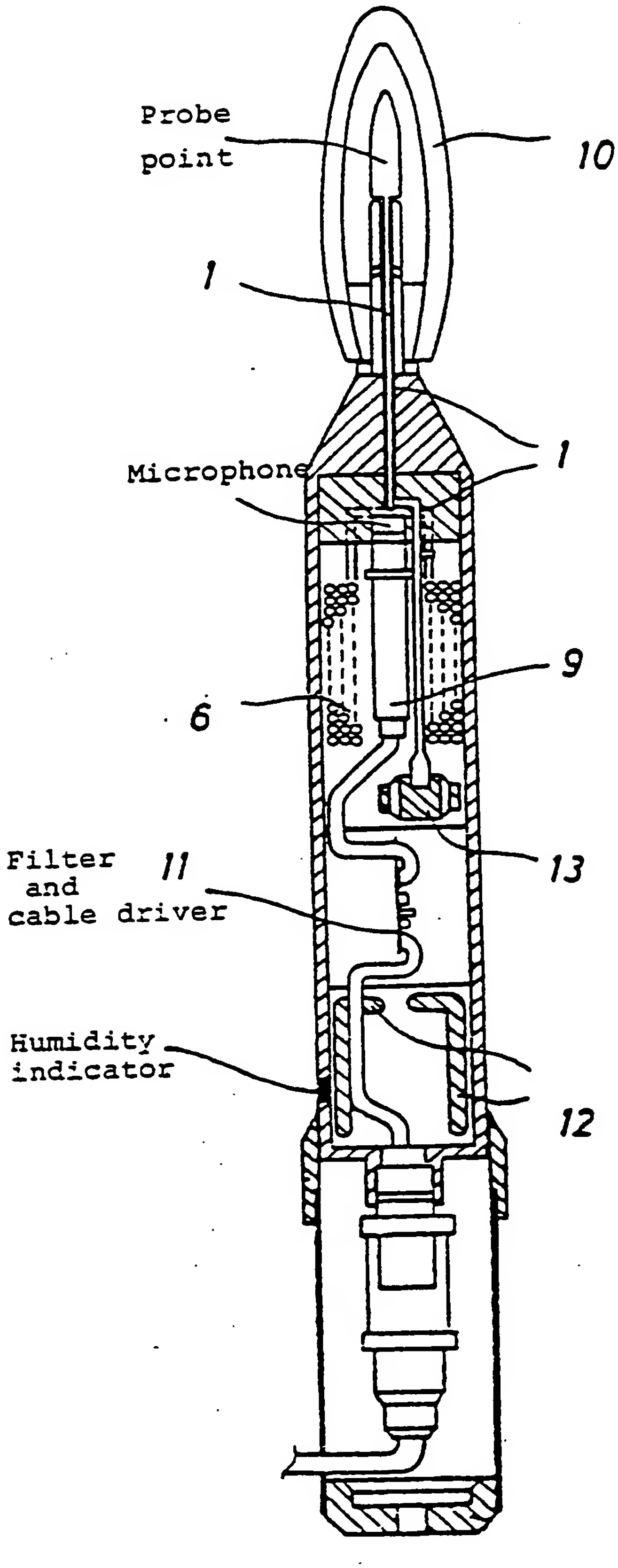


Fig.2


Probe
point
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Microphone
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Humidity
indicator
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Fig. 1

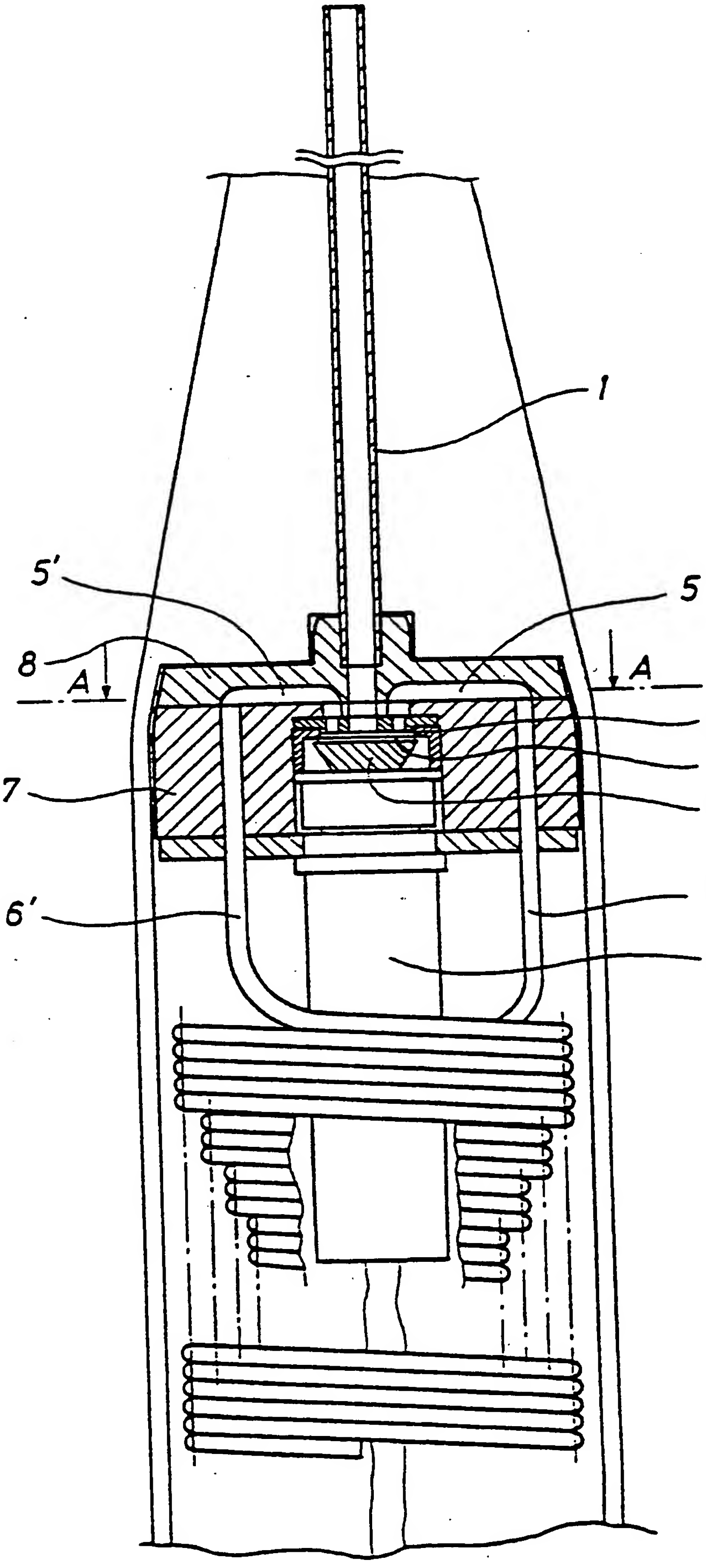


Fig. 2

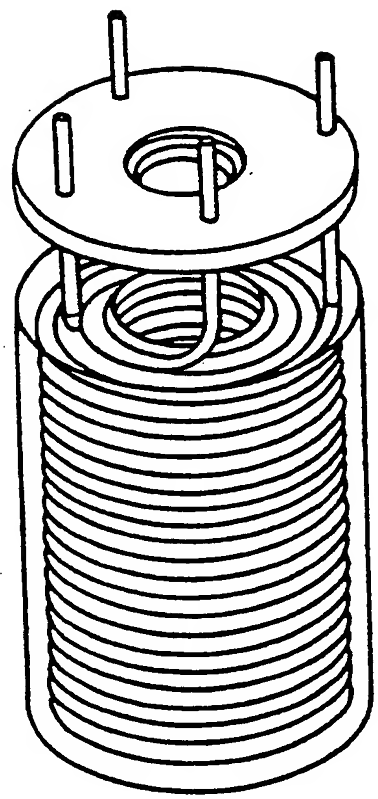
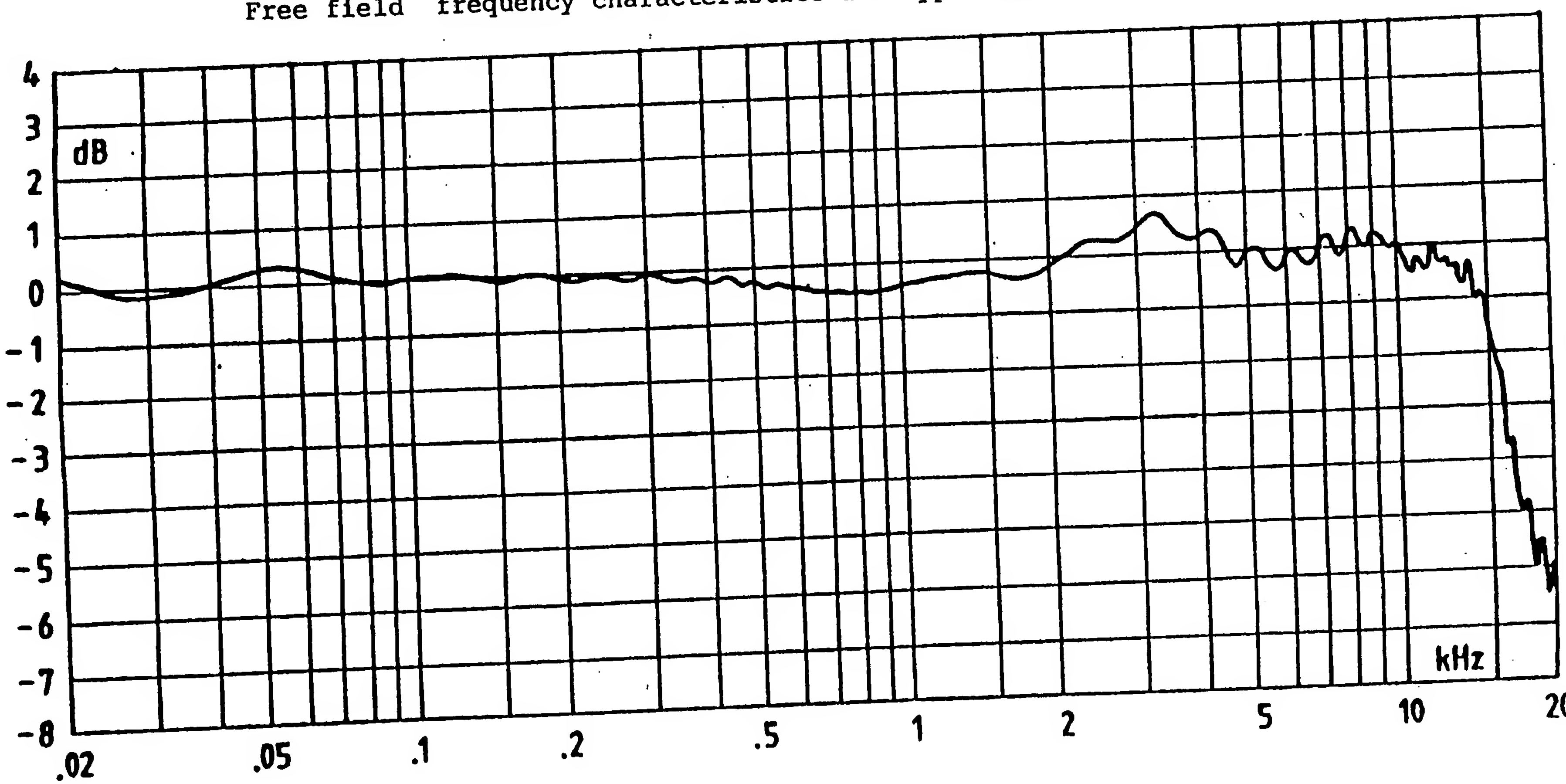


Fig. 3

Fig. 4

Free field frequency characteristics for Type 4184



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A PROBE MICROPHONE

The invention relates to a probe microphone comprising an acoustic transducer with a cavity to which a probe tube and an impedance matching tube are connected.

A probe microphone must be able to measure the sound pressure in a point, for instance in a very hot environment. An oblong probe tube in connection with a microphone cartridge, gives, however, some unwanted resonances. It has been attempted to solve this problem by means of an almost infinitely long tube to which a branch tube is connected, said branch tube being connected to a cavity and a microphone cartridge. As a result, unwanted resonances in a portion of the frequency interval are reduced. However, the microphone cartridge and the associated attachment is an unwanted load, especially at high frequencies.

The object of the invention is to provide a probe microphone with a more uniform frequency response.

The probe microphone according to the invention is characterised in that the impedance matching tube is divided into several small tubes of a total sectional area substantially corresponding to the sectional area of the probe tube. The small impedance matching tubes improve the frequency response because of their greater acoustic loss. Moreover, a further improvement is achieved if the impedance matching tubes are of different lengths, the already reduced reflections partly outbalancing each other.

The invention is described in greater detail below with reference to the accompanying drawings, in which

Fig. 1 illustrates a probe microphone according to the invention,

Fig. 2 illustrates the upper portion of the probe microphone on a large scale,

Fig. 3 is a perspective view of the associated impedance matching tubes, and

Fig. 4 illustrates the frequency response of the probe microphone.

The probe microphone of Fig. 2 comprises a probe tube 1. The probe tube 1 has an internal diameter of approximately 3.1 mm and a length of approximately 174 mm. The probe tube 1 extends into a circular cavity 2 in front of the membrane by a condensator microphone. The cavity 2 is approximately 25.5 mm^3. The diameter of the cavity 2 is approximately 9.3 mm. A stubconical back electrode 4 is placed below the membrane 3. Four grooves 5, 5', of which only two are shown, extend from the cavity 2. The grooves 5, 5' continue into separate tubes 6, 6'. The tubes 6, 6' have a length of 2,480 mm, 2,790 mm, 3,160 mm and 3,525 mm, respectively. The tubes 6, 6' are placed at the same angular distance in relation to the cavity 2. The internal diameter of the tubes is approximately 1.55 mm except where the tubes 6, 6' extend into the cavity 2, two small holes being adapted to provide a good matching. The said impedance matching tubes 6, 6' are carried through a solid body 7 to horizontal grooves 5, 5' in the upper body 8. The impedance matching tubes 6, 6' are twisted around a common core and embedded as shown in Fig. 3.

As mentioned above, the condensator microphone comprises a stubconical back electrode 4, placed in a cavity behind the membrane 3. The back electrode 4 is fastened to an insulator not shown. The microphone housing is the second electrode. The rest of the microphone body (the microphone cartridge) is seen below the stubconical back electrode 4. A switch is provided in the bottom of the cartridge, said switch being connected to a pre-amplifier 9 placed inside the reel of twisted impedance matching tubes 6, 6'.

Fig 1. shows the entire probe microphone. A wind screen 10 is seen on top. The wind screen 10 is made of foam material with open pores. The foam material is transparent to sound. Measuring the wind noise which might exist around a detached microphone is of no interest. The wind screen 10 reduces the air flow and consequently the wind induced noise. The probe tube 1 extend to the microphone from where the signal is transmitted to the pre-amplifier 9. An electric voltage is used for electric calibration of the system.

The measuring body influences the acoustic field to be measured. A measurement of the field without the presence of the microphone is required as the microphone influences the field. Also the probe system has a frequency response deviating from a flat frequency response. The latter also influences the system. The frequency response of the microphone is not flat either. A filter 11 compensates for all the above factors. An adaptation for achieving a low output impedance is provided by a cable driver in such a manner that relatively long cables can be drawn. The entire container is encapsuled and is kept dry for reasons of dependability by means of a dehumidifier 12. It is indicated when the dehumidifier 12 is used up.

The microphone is placed on a post or pole. A pole is raised and a screw cap is screwed to the top of the pole whereby the entire microphone unit becomes part of the pole. In this manner the sound field is disturbed as little as posssible. Alternatively, the microphone may be placed on a tripod. A special adaptor must be provided in order to fasten the microphone to the tripod.

It is preferred to calibrate with a known sound pressure to check if the microphone responds in the proper manner. It is however not possible to provide a sufficiently good sound source. The test sound source 13 serves to provide a relatively known sound in order to check if there is sound passage in the system.

Fig. 4 shows an example of free field characteristics of the probe microphone of Fig. 1. The curve is almost

flat in the interval 20-15 kHz. The use of several small matching tubes of different length improve especially the frequency response especially in the area below 5 kHz. Where the microphone is connected there is no impedance completely matching the impedance of the probe tube 1. A discontinuity therefore causes reflections at higher frequences. The fluctuations of the response at the high frequencies are however relatively small which is due to the form of the cavity 2 as a flow is carried through the cavity 2 in such a manner that the cavity forms part of the tube. The unwanted reflections at high frequencies are thereby reduced.

The condensator microphone may be replaced by another pressure measuring transducer, for instance based on a ceramic member.

CLAIMS

1. A probe microphone comprising an acoustic transducer with a cavity to which a probe tube and an impedance matching tube are connected, characterised in that the impedance matching tube is divided into several small tubes of a total sectional area substantially corresponding to the sectional area of the probe tube.

2. A probe microphone as claimed in claim 1, characterised in that the impedance matching tubes are of different lengths, whereby the stationary waves of each of the impedance matching tubes outbalance each other.

3. A probe microphone as claimed in claim 1 or 2, characterised in that the impedance matching tubes are twisted around a common core.

4. A probe microphone as claimed in claims 1 to 3, characterised in that the probe tube has an internal diameter of approximately 3.1 mm.

5. A probe microphone as claimed in claims 1 to 4, characterised in that there are four impedance matching tubes each having an internal diameter of approximately 1.5 mm.

6. A probe microphone as claimed in claim 5, characterised in that the four impedance matching tubes are of lengths of 2,480, 2,790, 3,160 and 3,525 mm, respectively.

7. A probe microphone as claimed in any of the preceeding claims, characterised in that the cavity is circular and has a diameter of approximately 9.3 mm.

8. A probe microphone as claimed in any of the preceeding claims, characterised in that the volume of the cavity is approximately 25.5 mm^3.

9. A probe microphone substantially as described above and with reference to the accompanying drawings.